

# APPENDIX H:

## Demand-Responsive Controls

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This appendix to the residential compliance manual addresses the demand-responsive (DR) control requirements in the *2022 Building Energy Efficiency Standards* (Energy Standards).

Demand response is an increasingly important function of buildings as distributed energy resources become more common and customers have access to time-of-use electricity rates and incentive programs designed to encourage demand side optimization. Demand response occurs on a range of timescales, from seconds to seasons, and represents any demand change in response to grid or economic needs. In addition to current time-of-use electricity rates, utilities in the future will likely connect electricity costs to high-frequency fluctuations in the supply and demand for electricity. Appropriate demand-responsive controls allow building operators to maintain the quality of services a building provides and reduce the total cost of energy by automating a building's response to changes in electricity rates.

The following definitions from §100.1 are relevant to the DR control requirements:

- **Demand response** is short-term changes in electricity usage by end-use customers, from their normal consumption patterns. Demand response may be in response to:
  - Changes in the price of electricity; or
  - Participation in programs or services designed to modify electricity use.
    - In response to wholesale market prices.
    - When system reliability is jeopardized.
- **Demand-response period** is a period during which electricity loads are modified in response to a demand-response signal.
- **Demand-response signal** is a signal that indicates a price or a request to modify electricity consumption for a limited period.
- **Demand responsive control** is an automatic control that is capable of receiving and automatically responding to a demand response signal.

The DR control requirements ensure that the building is DR capable (i.e., capable of responding to a DR signal). The decision to employ demand response is up to the building owner or manager, in coordination with their utility company or a governing authority or both. A building capable of receiving and responding to a demand response signal is sufficient to meet the requirements of the Energy Standards. DR-capable is described as follows:

- **DR-capable:** A building is capable of DR when the building has loads that can be curtailed, DR controls are installed, and the controls have been programmed/configured so the test control strategy that is defined in the building code can be deployed. (The DR controls can be programmed with additional control strategies.)
- **DR-enabled:** The DR of a building is enabled when the connection between the entity that sends the DR signal and the DR control in the building has been tested and communications have been allowed or “enabled.”

- **DR-enrolled:** A building is enrolled when the building owner/occupant has enrolled in a DR program. (This may include updating the settings or programming of the DR controls to better match the terms of the program.)

The requirements for DR controls only apply if the controls are used to comply with the building standards (i.e., DR thermostats or a heat pump water heater). If DR control are installed voluntarily and do not contribute to compliance with minimum code requirements, they do not need to adhere to requirements in Title 24, Part 6.

For residential dwellings, DR controls are only required as a part of specific Exceptions to HVAC and Solar Ready requirements.

## **Communications Requirements for DR Controls**

### *§110.12(a)1-5*

There are two main communication requirements that apply to all DR controls:

- The control must, at minimum, be able to understand a signal sent using OpenADR.
- The control must, at a minimum, be able to communicate with the virtual end node using a wired or wireless bidirectional communication pathway.

These are minimum requirements, meaning that the control can have (and use) additional communication features provided that the required features are included.

## **Communication With Entity That Initiates DR Signal**

### *§110.12(a)1*

DR controls must have the capability of communicating with the entity that initiates a DR signal by way of an OpenADR-certified virtual end node (VEN).

The OpenADR is the primary open-standard protocol used in the California market. It implements a profile within the Organization of Structured Information Standards (OASIS) Energy Interoperation information and communication model that defines two types of communications entities — virtual top nodes (VTNs) and virtual end nodes (VENs). VTNs are information exchange servers typically operated by utilities or third-party providers and can dispatch events. VENs are the recipients of DR payloads and are typically the gateway or end-use devices installed at customer facilities throughout a dispatcher's territory. See OpenADR Alliance's website (<http://www.openadr.org/>) for more information about OpenADR certified VENs.

There are two ways to comply with the OpenADR certified VEN requirement:

### **Option A: Install an OpenADR 2.0a, 2.0b certified VEN, or a certified Baseline Profile OpenADR 3.0 VEN within the building as part of the DR control system (§110.12(a)1A)**

If complying using Option A (§110.12[a]1A), the designer of the DR control system(s) must select a VEN that the OpenADR Alliance has certified as being compliant with the OpenADR 2.0a, 2.0b specification or Baseline Profile OpenADR 3.0. The OpenADR Alliance maintains a

[list of certified VENs](https://products.openadr.org/) (<https://products.openadr.org/>). If using Option A, the certified VEN must be installed inside the building at the time of inspection. The building can comply if the DR control system has a certified VEN that is incorporated into a networked system of devices such that the single VEN communicates control strategy information to multiple devices in the network (e.g., a gateway system), or if each device (e.g., thermostat) in the building is itself a certified VEN.

**Option B: Install a DR control system that has been certified to the Energy Commission as being capable of communicating with an OpenADR 2.0b certified VEN or a Baseline Profile OpenADR 3.0 certified VEN (§110.12[a]1B)**

If complying using Option B (§110.12[a]1B), the designer of the DR control system(s) must select a DR control system that the Energy Commission has approved for the certified list of DR control systems. The Energy Commission maintains a [list of certified products and instructions on how manufacturers can certify products](#) on their website at [http://www.energy.ca.gov/title24/equipment\\_cert/](http://www.energy.ca.gov/title24/equipment_cert/). If using Option B, the manufacturer of a DR control system must submit documentation to the Energy Commission confirming that the DR control system is capable of communicating with an OpenADR 2.0b-certified VEN or a Baseline Profile OpenADR3.0-certified VEN. Demand-responsive controls must be programmed or configured so any test control strategy defined in building code can be deployed at the time of permitting.

Option B requires that the manufacturer of the DR control system certify to the Energy Commission that the control system is capable of communicating with an OpenADR 2.0b-certified VEN or a Baseline Profile OpenADR3.0-certified VEN. This requirement does not mean that the DR control system must be connected to a 2.0b-certified VEN or a Baseline Profile OpenADR3.0-certified VEN. When the DR control system is connected to a VEN, it can be connected to either a 2.0a- or 2.0b-certified VEN or a Baseline Profile OpenADR3.0-certified VEN.

The DR control system must comply with Option A or Option B, but the control system can also include features that allow the control system to use other communications protocols.

When specifying DR control systems, it is recommended that the controls designer check to see which DR programs are available in the area and specify controls that are compliant with Title 24, Part 6, and eligible for the area's DR programs.

## **Other Requirements for DR Controls**

### **Perform Regular Functions When Not Responding to DR Events**

#### *§110.12(a)4*

Controls that include demand response with other control functions must perform the regular control functions, as required by other parts of the building code, when the control is not performing DR-related functions. This includes when the controls are not responding to a DR event, when the DR functions are not enabled (see description of DR-enabled in the introduction to this chapter of the compliance manual) or when the DR controls are temporarily disabled or disconnected (e.g., due to a network outage).

For example, if the building owner/operator never enables the DR controls or enrolls in a DR program, the building control system(s) must comply with all other applicable controls requirements and continue to provide those control functions. Similarly, if the building owner/operator does enable the DR controls and is enrolled in a DR program, the building control system(s) must perform as required by the applicable building code requirements whenever the building is not participating in a DR event. The DR control functionality is an additional control feature on top of all the other required building controls.

### **Certification Requirements for DR Thermostats**

#### *§110.12(a)5*

Residential DR thermostats, also called occupant-controlled smart thermostats (OCSTs), must comply with the technical specifications described in Joint Appendix 5 (JA5). According to the requirement in JA5, manufacturers of DR thermostats must submit documentation to the Energy Commission to certify that the thermostat meets the code requirements. See the [Energy Commission's website for a list of certified products and instructions on how manufacturers can certify products](http://www.energy.ca.gov/title24/equipment_cert/) on their website at [http://www.energy.ca.gov/title24/equipment\\_cert/](http://www.energy.ca.gov/title24/equipment_cert/).

### **Energy Management Control Systems and Home Automation Systems**

Required thermostatic and lighting control functions (including DR control functions) can be incorporated into and performed by an energy management control system (EMCS). Using an EMCS to perform these control functions complies with Title 24 provided that all the criteria that would apply to the control are met by the EMCS.

A home automation system that manages energy loads (such as HVAC and lighting systems) is considered a type of energy management control system and, as such, can similarly incorporate the ability to provide required control functions.